Fishery Data Series No. 15-31

Coho and Chinook Salmon Smolt Releases into Cook Inlet, Prince William Sound, and Resurrection Bay, Alaska, 2011

by

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and

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September 2015

Alaska Department of Fish and Game **Divisions of Sport Fish and Commercial Fisheries**

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Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat or long
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$\log_2$, etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

FISHERY DATA SERIES NO. 15-31

COHO AND CHINOOK SALMON SMOLT RELEASES INTO COOK INLET, PRINCE WILLIAM SOUND, AND RESURRECTION BAY, ALASKA, 2011

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ABSTRACT

In 2011, the Alaska Department of Fish and Game released approximately 944,144 coho salmon (*Oncorhynchus kisutch*) smolt and 1,656,154 Chinook salmon (*O. tshawytscha*) smolt in Cook Inlet, Prince William Sound, and Resurrection Bay to increase angling opportunity and relieve angling pressure on wild stock salmon populations. There were 12 Chinook salmon and 6 coho salmon release groups in all. Every smolt in each release group was thermally marked to later identify the release area of returning adults. Chinook salmon smolt from 3 groups released at brood collection sites (264,306 thermally marked fish) were also marked with an adipose finclip to identify hatchery fish (adipose fin missing) from naturally produced fish (adipose fin present) in the fishery, brood collections, and escapements at those sites. Fish size distribution at time of release was estimated for all 3 Chinook salmon release groups with adipose-finclipped fish and 1 coho salmon release group without adipose finclips. All 3 of the adipose-finclipped Chinook salmon release groups achieved a smolt production goal of 80% within a target size range of 5.1–15.0 g. Although the coho salmon smolt production goal was to have 80% of the release group within a target size range of 15.1–25.0 g, only 49.2% fell within the target size range. Smolt were enumerated during finclipping in 3 Chinook salmon release groups. Hatchery inventory methods were used to estimate the number of all 6 coho salmon release groups and the 9 Chinook salmon release groups that did not receive adipose finclips.

Key words: hatchery, adipose finclip, thermal marking, otolith, Chinook salmon, *Oncorhynchus tshawytscha*, coho salmon, *Oncorhynchus kisutch*, tag retention, size composition.

INTRODUCTION

Southcentral Alaska receives most of the state's sport fishing effort. Chinook salmon (*Oncorhynchus tshawytscha*) and coho salmon (*O. kisutch*) smolt reared at Alaska Department of Fish and Game (ADF&G) Division of Sport Fish (SF) hatcheries have been stocked in numerous locations throughout Southcentral Alaska to improve or create terminal sport fisheries and to relieve pressure on wild stocks (Appendices A1 and A2). One element of the coho and Chinook salmon hatchery smolt stocking projects in Cook Inlet, Prince William Sound, and Resurrection Bay is the use of thermal marks (TM) to identify fish. All fish raised at Fort Richardson Hatchery (FRH) are thermal marked. In 2011, 100% of 3 release groups of salmon smolt were also marked with an adipose finclip. TMs and adipose finclips are used to estimate the contribution of hatchery stockings to commercial fisheries, marine and freshwater recreational fisheries, and personal use fisheries. They can also be used to estimate spawning escapement in stocked streams, and estimate straying of stocked coho and Chinook salmon.

The accuracy of hatchery contribution estimates is highly dependent upon the accuracy of the estimated number of fish released. To ensure the greatest accuracy in determining the number of fish in release groups, 3 methods are used at FRH: a clipping inventory (CI) count, a hatchery inventory (HI) estimate, and a water volume displacement (WV) estimate. These are compared and the best estimate is used.

Another important element of hatchery smolt stocking programs is fish size. Weight and length of smolt at release are indicators of quality (Peltz and Starkey 1993). If smolt are too small at release, then ocean survival will be poor; and if smolt are too large at release, then ocean residence time will be reduced, thus shifting age composition of returns to younger, smaller fish (Sweet and Peltz 1994). To maximize ocean survival of hatchery smolt and to achieve an age composition similar to the age composition of the existing population, Peltz and Starkey (1993) recommended that upon release, 80% of hatchery coho salmon smolt weigh between 15.1 and 25.0 g, and that 80% of hatchery Chinook salmon smolt weigh between 5.1 and 15.0 g.

This project documented the release of Chinook and coho salmon smolts with TMs and adipose finclips in Cook Inlet, Prince William Sound, and Resurrection Bay in 2011. Specific objectives for this project were as follows:

1. Verify the TM applied to the otoliths of fish in each coho and Chinook salmon release group.
2. Estimate the weight distribution of each Chinook salmon smolt release group with adipose finclips and 1 coho salmon smolt release group.

Our finclipping goal was to mark all Chinook salmon smolt in 3 release groups with an adipose finclip. A second goal was to mark all fish in all release groups with a thermal mark. We also compared smolt abundance by applying hatchery inventory (HI) and water volume displacement (WV) estimates to the clipping inventory (CI) count for all Chinook salmon release groups marked with an adipose finclip.

Included in this report are recommendations for future marking and collecting of smolt release data. All data for this report are held and archived by Research and Technical Services, Sport Fish Division, Alaska Department of Fish and Game.

METHODS

Coho salmon smolt from Bear Lake, Ship Creek (Little Susitna River), and Eklutna Tailrace (Jim Creek) donor stocks were raised at Fort Richardson Hatchery (FRH). Chinook salmon smolt from Deception Creek, Ship Creek, Crooked Creek, and Ninilchik River donor stocks were also raised at FRH (Table 1). Fish from 18 release groups were stocked at 10 locations in Cook Inlet, 3 locations in Prince William Sound, and 1 location in Resurrection Bay.

Table 1.–Total number of fish stocked at 14 locations in Cook Inlet, Prince William Sound, and Resurrection Bay in 2011.

Species	Release area[a]	Release location	Donor stock	Inventory method	Estimated number in release group
Chinook salmon					
	CI	Crooked Creek	Crooked Creek	clipping	64,578[b]
	CI	Deception Creek	Deception Creek	clipping	140,266
	CI	Eklutna Tailrace	Ship Creek	hatchery	122,962[b]
	CI	Halibut Cove	Ninilchik River	hatchery	107,338[b]
	CI	Homer Spit	Crooked Creek	hatchery	108,003[b]
	CI	Homer Spit	Ninilchik River	hatchery	111,784[b]
	CI	Ninilchik River	Ninilchik River	clipping	59,462
	CI	Seldovia Harbor	Ninilchik River	hatchery	103,382[b]
	CI	Ship Creek	Ship Creek	hatchery	314,194[b]

-continued-

Table 1.–Part 2 of 2.

Species	Release area[a]	Release location	Donor stock	Inventory method	Estimated number in release group
Chinook (cont.)					
	PWS	Cordova, Fleming Spit	Deception/Ship Creeks	hatchery	86,428
	PWS	Valdez, Old Town Site	Deception Creek	hatchery	113,782[b]
	PWS	Whittier	Deception Creek	hatchery	100,094[b]
	RB	Seward Lagoon	Crooked Creek	hatchery	108,890
	RB	Seward Lagoon	Crooked/Ship Creeks	hatchery	114,991
Coho salmon					
	CI	Bird Creek	Ship Cr (Little Susitna River)	hatchery	136,047
	CI	Campbell Creek	Ship Cr (Little Susitna River)	hatchery	71,960
	CI	Eklutna Tailrace	Jim Creek	hatchery	97,087
	CI	Homer Spit	Ship Cr (Little Susitna River)/Bear Lake	hatchery	129,080
	CI	Ship Creek	Ship Cr (Little Susitna River)	hatchery	254,718
	RB	Seward Lagoon	Bear Lake	hatchery	255,252
Total					2,535,720

[a] CI is Cook Inlet; PWS is Prince William Sound; RB is Resurrection Bay.

[b] Estimated release number adjusted for mortalities that occurred at release sites during imprinting.

SMOLT MARKING

Adipose Finclips

All Chinook salmon smolt in 3 release groups were adipose-finclipped (Table 2). Fish were anesthetized with Tricaine Methane Sulfonate (MS-222) before finclipping. The adipose fin was excised at the base using surgical scissors. Finclipped fish were transferred to the rearing unit following clipping and held until release. Fish mortality was monitored daily and all adipose-finclipped mortalities were recorded.

Table 2.–Summary of adipose finclipping data including number of fish clipped and smolt release estimates by clipping inventory for Chinook salmon stocked in Cook Inlet, 2011.

	Chinook salmon release site			
Release parameter	Crooked Creek	Deception Creek	Ninilchik River	Totals
Initial number	66,799	146,584	60,210	273,593
Hatchery mortalities	1,982	6,318	748	9,048
Total fish released (clipping inventory) [a]	64,817	140,266	59,462	264,545

[a] Estimated number of fish loaded into fish transport truck. Transfer and imprinting mortalities are not accounted for in this value.

Thermal Marks (TMs)

Thermal marks were applied to all Chinook and coho salmon embryos before hatching. Thermal mark patterns were assigned by the Mark, Tag, and Age Laboratory operated by ADF&G Division of Commercial Fisheries (Table 3). At approximately 310 cumulative temperature units (CTUs)—number of days postfertilization multiplied by average daily temperature in centigrade—for coho salmon and 360 CTUs for Chinook salmon, otoliths were developed

enough to accept a mark, as verified by the Mark, Tag, and Age Laboratory. Embryos were exposed to a series of 4–5°C water temperature changes (both increases and decreases), with each temperature decrease resulting in the deposit of a dark protein ring on the developing otolith (Monk *Unpublished*). Water temperature changes were scheduled every 24 hours, with a 72-hour warm water exposure occurring between bands of rings. The assigned patterns of dark protein rings applied to the otoliths (Figure 1) are used to identify the area of release from returning adult salmon. Onset Stowaway XTI data loggers recorded incubation water temperature every 15 minutes during the marking period to generate thermal profiles for each mark type (Figure 2).

Voucher samples containing approximately 50 fish from each egg lot (eggs from individual egg-take events) were collected before moving fish to the raceways (ponding) and were submitted to the Mark, Tag, and Age Laboratory for mark verification.

Table 3.–Summary of Chinook and coho salmon thermal marks (hatch codes) for smolt stocked at locations in Cook Inlet, Prince William Sound, and Resurrection Bay in 2011.

Species	Release area [a]	Intended hatch code	Comments [b]	Release locations
Chinook salmon				
	CI	2,3H	Majority of samples have a 2,3H mark. A few show variants of a 2,3,1H and a 2,4H mark.	
				Crooked Creek
				Deception Creek
				Eklutna Tailrace
				Halibut Cove
				Homer Spit
				Ninilchik River
				Seldovia
				Ship Creek
	PWS	2,4H	Nice mark. Some noise post mark.	
				Fleming Spit
				Valdez
				Whittier
	RB	2,5H	Nice mark. Some noise post mark.	
				Seward Lagoon
Coho salmon				
	CI	1,5H	Decent mark. A few slides look like a 6H because of a light ring between the bands.	
				Bird Creek
				Campbell Creek
				Eklutna Tailrace
				Homer Spit
				Ship Creek
	RB	2,4H	Nice mark.	
				Seward Lagoon

Source: Comments posted by Commercial Fisheries Division Mark, Tag, and Age Laboratory Voucher Summary Report.

[a] CI is Cook Inlet; PWS is Prince William Sound, RB is Resurrection Bay.

[b] Thermal mark hatch codes indicate the number of rings within each band.

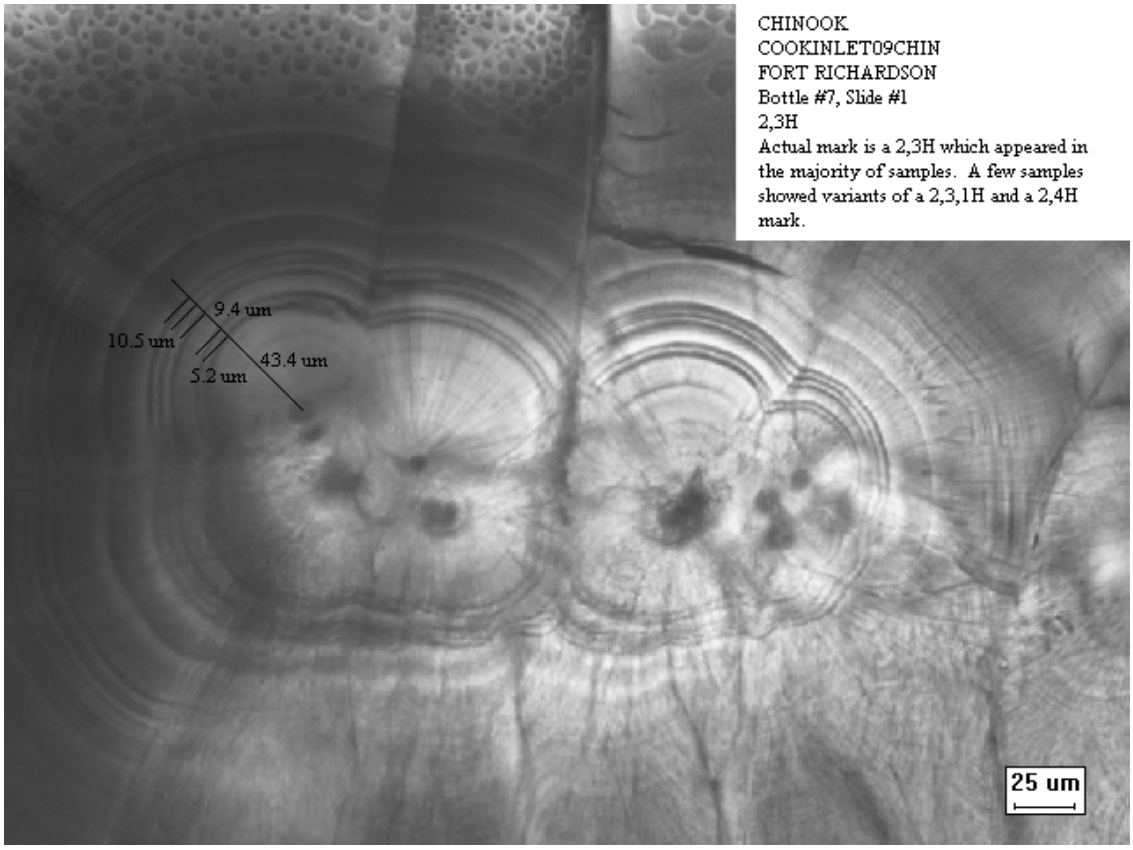

Figure 1.–Image of thermal mark applied to Chinook salmon released into Cook Inlet.

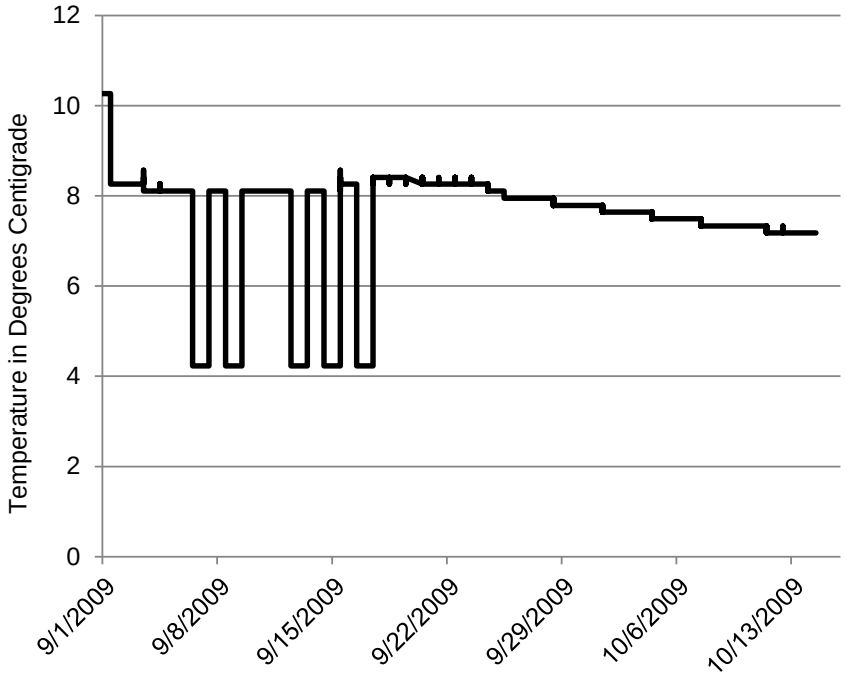

Figure 2.–Thermal marking temperature profile for Chinook salmon released into Cook Inlet in 2011 with a thermal mark (hatch code) of 2,3H.

Coho salmon

Coho salmon were thermally marked in 2009 at the eyed egg stage of development (Table 3). Different TMs consisting of 2 bands were applied to identify fish as belonging to Cook Inlet or Resurrection Bay release groups. Cook Inlet release groups were indicated by 1 band of 1 ring followed by 1 band of 5 rings (1,5H), and Resurrection Bay release groups were indicated by 1 band of 2 rings followed by 1 band of 4 rings (2,4H).

Chinook salmon

Chinook salmon were thermally marked in 2009 at the eyed egg stage of development (Table 3). Different TMs consisting of 2 bands were applied to identify fish as belonging to Cook Inlet, Prince William Sound, or Resurrection Bay release groups. The first band consisted of 2 rings for all fish, and the second band consisted of 3 rings for Cook Inlet release groups (2,3H), 4 rings for Prince William Sound release groups (2,4H), and 5 rings for Resurrection Bay release groups (2,5H).

SMOLT ENUMERATION

The number of fish in all 18 release groups was obtained (before release) using the clipping inventory (CI) count, hatchery inventory (HI) abundance estimate, water volume displacement (WV) abundance estimate, or a combination thereof (see below for details on each of these methods). The CI counts were compared to the HI and WV estimates to determine the precision of the HI and WV estimates. In raceways where a CI was not conducted, and the HI and WV point estimates differed by less than 10%, the HI estimates were used. If the point estimates differed by more than 10%, the estimate from the technique determined to be more accurate when compared to the CI was used.

Clipping Inventory (CI)

A CI count was obtained from mechanical tally counters for the 3 Chinook salmon release groups in which every fish was adipose-finclipped. Thus, the number of finclipped fish counted for each release group equaled the number of fish in each release group. For these release groups, fish mortality was monitored daily and subtracted from the original CI count to yield a final fish count for each release group.

Hatchery Inventory (HI) Estimates

The HI abundance technique used at Fort Richardson Hatchery (FRH) was based on the weight of fish in a raceway. These estimates were obtained when fry were moved from small indoor raceways to large outdoor raceways. Three samples (net loads of fish)—one each from the head, middle, and tail sections of the raceway—were obtained to estimate the mean fish weight. If the fish were congregated at one end of the raceway, the samples were obtained from the congregation of fish. If a sample varied by more than 5% from the other samples, another sample was obtained. Because a net load of fish is too large to enumerate (approximately 600–800 fish), the net was manually halved numerous times until a visually estimated 50–100 fish remained in the net. These fish were poured into a preweighed bucket of water, weighed to the nearest gram, and hand counted from the bucket to determine mean fish weight. Mean weight was estimated for each sample by dividing the total weight of the fish counted by the number of fish counted. The total weight of fish, obtained using the accumulative weight feature on the electronic scale, was then divided by the mean fish weight to establish the HI abundance estimate in that raceway.

The number of fish released from an outdoor raceway equaled the original outdoor raceway estimate minus the fish stocked or transferred, and minus the mortalities from date of loading into the outdoor raceway to the date of release.

Volumetric Estimates (WV)

Fish abundance (number or weight) was also estimated volumetrically using the known size of the transport tank used to transport fish to the release site. This estimate is a function of the tank volume (gallons), the ratio of the volume of water displaced in the tank sight gauge to the volume of water placed in the tank (mm/gallon), and the ratio of the number (or weight) of fish that displace a volume of water in the tank sight gauge (fish/mm or kg/mm).

For fish transport, each tank was filled with water and the water level on the tank sight gauge recorded to the nearest millimeter. Fish were then pumped from the raceway into each of the transport tanks. The water level on the tank gauge was recorded again after fish were loaded into each of the tanks. The millimeters of water displaced for each tank was determined, and using a known displacement value of kilograms of fish per millimeter (Appendix B1), the total weight of fish in the tank was estimated. Total number of fish was estimated by dividing the total fish weight by the mean fish weight.

FRH estimated mean weight by obtaining fish samples from 5 nets of fish before loading the tanks. Each net of fish was split in half several times until the desired sample size (50–100 fish) was achieved. The fish were poured into a preweighed bucket of water, weighed to the nearest gram, and counted out of the bucket. Mean weight was calculated for each of the 5 samples, and an overall mean weight was calculated by summing the 5 sample mean weights and dividing by the sum of the 5 fish counts.

SIZE ESTIMATION

A sample of fish from each raceway containing adipose-finclipped Chinook salmon and 1 raceway of coho salmon were individually weighed and measured. Fish were crowded to one end of the raceway and a minimum of 510 fish were dipnetted and put into a small holding pen. Each fish sampled was measured to the nearest millimeter and weighed to the nearest 0.1 g.

RESULTS

SMOLT MARKING

Adipose Fin Clips

Based on clipping inventory counts, 264,545 Chinook salmon smolt with an adipose finclip were released in Cook Inlet in 2011 (Table 2). The goal of 100% of the Chinook salmon adipose finclipped in 3 release groups was achieved.

Thermal Marks (TMs)

Thermal profiles recorded by the Onset Stowaway XTI data loggers indicate that water temperature changes to apply TMs occurred as scheduled. A majority of the TM digital images of voucher samples for Cook Inlet Chinook salmon releases had the target 2,3H TM; however, TM digital images of a few Cook Inlet voucher samples revealed 2,3,1H and 2,4H TM variants. Likewise, the TM digital images of some voucher samples in the Cook Inlet coho salmon releases revealed a 6H TM variant instead of the target 1,5H TM. The Prince William Sound

Chinook salmon releases and the Resurrection Bay Chinook and coho salmon release groups were marked with their assigned TM (Table 3).

SMOLT RELEASES

In 2011, Fort Richardson Hatchery (FRH) released an estimated 944,144 coho salmon smolt at 6 locations in Cook Inlet and Resurrection Bay and an estimated 1,656,154 Chinook salmon smolt at 12 locations in Cook Inlet, Prince William Sound, and Resurrection Bay (Table 1).

SMOLT ENUMERATION

Clipping inventory (CI) counts were reported and compared to the results of hatchery inventory (HI) and water volume displacement (WV) estimation techniques for the 4 rearing units that contained the 3 adipose-finclipped Chinook salmon release groups; the HI estimates were within 8.6% of the CI count, and the WV estimates were within 14.6% of the CI count (Table 4). The difference between the HI and WV estimates was greater than 10% for 3 of the 18 Chinook salmon rearing units. Because the HI estimates were more accurate than the WV estimates when compared to the CI counts, HI estimates were reported as the release number for all 8 of the 9 coho salmon rearing units (944,144 smolt, including mortality at the release site) and all 14 rearing units of Chinook salmon without finclips (1,391,848 smolt, including mortality at the release site) (Table 4). The WV estimate was reported for the rearing unit containing Campbell Creek coho salmon because only a portion of the fish in that rearing unit were released into Campbell Creek.

SIZE ESTIMATION

The production goal for coho salmon was to have 80% of the fish weigh between 15.1 and 25.0 g. The 1 coho salmon release group (Bird Creek) sampled for weight did not achieve the production goal (49.2%, Table 5). The production goal for Chinook salmon was to have 80% of the fish weigh between 5.1 and 15.0 g. All 3 Chinook salmon release groups achieved the production goal (Crooked Creek = 88.4%, Deception Creek = 83.8%, Ninilchik River = 92.0%) (Table 5).

Table 4.–A comparison of hatchery inventory (HI) estimates, water volume displacement (WV) population estimates, and clipping inventory (CI) counts (where available) for Chinook and coho salmon reared at Fort Richardson Hatchery and released in 2011.

Release species and site	Rearing unit	Smolt abundance estimate			Difference			Mortality [b]		Reported release number
		HI[a]	WV[a]	CI[a]	CI/HI	CI/WV	HI/WV	Number	Percent	
Chinook salmon with finclips										
Crooked Creek	D2A	61,679	75,928	64,817	-5.1%	14.6%	18.8%	239	0.37	64,578
Deception Creek	C2	97,682	98,226	92,838	5.0%	5.5%	0.6%			92,838
Deception Creek	C3B	51,882	48,504	47,428	8.6%	2.2%	-7.0%			47,428
Ninilchik River	D2B	62,970	62,750	59,462	5.6%	5.2%	-0.4%			59,462
Chinook salmon without finclips										
Eklutna Tailrace	A4	66,230	58,800				-12.6%	350	0.53	65,880
Eklutna Tailrace	C3A	57,082	63,137				9.6%			57,082
Fleming Spit	B4	86,428	85,400				-1.2%			86,428
Halibut Cove	D3A	109,978	110,031				0.0%	2,640	2.40	107,338
Homer Spit	C4	111,784	108,769				-1.1%			111,784
Homer Spit	D1	112,244	116,553				4.1%	4,241	3.78	108,003
Seldovia	D4	110,887	110,772				-0.1%	7,505	6.77	103,382
Seward Lagoon	B1	108,890	109,148				0.2%			108,890
Seward Lagoon	B2	114,991	110,656				-3.9%			114,991
Ship Creek	A1	108,677	113,661				4.4%	489	0.45	108,188
Ship Creek	A2	110,687	108,721				-1.8%	498	0.45	110,189
Ship Creek	A3	96,250	95,804				-0.5%	433	0.45	95,817
Valdez	C1	114,194	109,600				-4.2%	412	0.36	113,782
Whittier	B3	100,194	83,714				-19.7%	100	0.10	100,094
Coho salmon without finclips										
Bird Creek	F3	124,270	124,462				0.2%			124,270
Bird Creek[c]	E3	11,777								11,777
Campbell Creek[d]	E3		71,960							71,960
Eklutna Tailrace	F2	97,087	92,023				-5.5%			97,087
Homer Spit	F1	129,190	118,981				-8.6%	110		129,080
Seward Lagoon	E1	127,606	122,018				-4.6%			127,606
Seward Lagoon	E2	127,646	121,677				-4.9%			127,646
Ship Creek	F4	127,628	134,909				5.4%	381		127,247
Ship Creek	E4	127,853	117,811				-8.5%	382		127,471
Total										2,600,298

-continued-

Table 4.–Part 2 of 2.

Note: For rearing units that did not contain tagged fish, neither a tagging inventory nor comparisons to a tagging inventory could be obtained.

[a] Abundance estimate was established at Fort Richardson Hatchery before any transfer or posttransfer mortality occurred.

[b] Mortality includes fish that died during transfer, release, or imprinting at the release site.

[c] Estimate equals the hatchery inventory of 83,737 for raceway E3 minus 71,960 displacement estimate for the Campbell Creek release.

[d] A hatchery inventory estimate is not available for Campbell Creek because not all of the fish in the raceway were released into Campbell Creek.

Table 5.–The percentage of fish within, below, or above production goal target size for adipose finclipped Chinook salmon release groups and 1 coho salmon release group from Fort Richardson Hatchery in 2011.

		Percent with respect to production goal		
Species	Release group	Below	Within	Above
Coho salmon [a]				
	Bird Creek	48.3%	49.2%	2.5%
Chinook Salmon [b]				
	Deception Creek	0.1%	83.9%	16.0%
	Ninilchik River	0.2%	92.0%	7.8%
	Crooked Creek	0.3%	88.4%	11.3%

[a] Production goal target for coho salmon: 80% of smolt between 15.1 and 25.0 g

[b] Production goal target for Chinook salmon: 80% of smolt between 5.1 and 15.0 g

DISCUSSION

SMOLT MARKING

Managers use adipose finclips on hatchery-released fish to manage sport fisheries that target adult Chinook salmon returning to the Ninilchik and Kasilof rivers. Properly clipped fins are essential so that anglers and enforcement officials can distinguish between hatchery and nonhatchery fish.

Thompson and Blankenship (1997) found no fin regeneration in returning adult coho salmon when adipose fins were entirely removed at 12 months of age. When only the posterior two-thirds or the top two-thirds of the fin was removed, complete fin regeneration occurred in 23% of the fish. Partial fin regeneration occurred in 35% of the fish when the posterior two-thirds was removed, and in 63% of the fish when the top two-thirds was removed. Returning adults with partially regenerated adipose fins might not be identified as hatchery fish.

Thermal Marking

Cook Inlet Chinook salmon TM variant 2,4H otoliths could be misidentified as an intended 2,4H TM for Chinook salmon released by ADF&G into Prince William Sound (Table 3). Cook Inlet coho salmon TM variant 6H could be misidentified as an intended 6H TM from coho salmon released by Valdez Fisheries Development Association Inc. into Boulder Bay or Solomon Gulch in Prince William Sound.

SMOLT ENUMERATION

Peltz and Hansen (1994) reported that numerous sources of error associated with water displacement values make the water volume (WV) displacement method of estimating populations unreliable. They recommended this method be used only when other estimation methods cannot be used or when accuracy is not important.

For each of the 3 adipose finclipped Chinook salmon release groups, the hatchery inventory (HI) estimates were within 6.9% of the clipping inventory (CI) counts, and the CI counts and WV estimates were within 14.6% of each other. Improved techniques based on the weight of fish in each release group since 1997 have made the HI method as reliable as the mark–recapture method at Fort Richardson Hatchery (FRH) (Starkey et al. 1999). Improved transport tank loading techniques, such as eliminating immeasurable water when loading the tanks and taking accurate site gauge readings, probably account for the increased reliability of WV estimates at FRH.

SIZE ESTIMATION

To maximize ocean survival and maintain the age composition of the population, Peltz and Starkey (1993) recommended that 80% of hatchery coho salmon smolt weigh between 15.1 and 25.0 g, and hatchery Chinook salmon weigh between 5.1 and 15.0 g at release. The smaller-than-recommended release size for the Bird Creek coho salmon release group may reduce ocean survival resulting in fewer adult coho salmon returning in 2012.

RECOMMENDATIONS

1) During thermal marking, temperature changes of 4–5°C should occur every 24 hours between rings, and every 72 hours between bands of rings.
2) Production goal size recommendations should be followed such that 80% of coho salmon weigh between 15.1 and 25.0 g, and 80% of Chinook salmon weigh between 5.1 and 15.0 g at release.

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REFERENCES CITED

Loopstra, D., and P. A. Hansen. 2005. Marking, enumeration, and size estimation for coho and Chinook salmon smolt releases into Upper Cook Inlet, Resurrection Bay and Prince William Sound, Alaska, 2001-2003. Alaska Department of Fish and Game, Fishery Data Series No. 05-22, Anchorage. http://www.adfg.alaska.gov/FedAidPDFs/Fds05-22.pdf

Loopstra, D., and P. A. Hansen. 2007. Coho and Chinook salmon smolt releases into Cook Inlet, Prince William Sound, and Resurrection Bay, Alaska, 2004. Alaska Department of Fish and Game, Fishery Data Series No. 07-75, Anchorage. http://www.adfg.alaska.gov/FedAidPDFs/fds07-75.pdf

Loopstra, D., and P. A. Hansen. 2008. Coho and Chinook salmon smolt releases into Cook Inlet, Prince William Sound, and Resurrection Bay, Alaska, 2005. Alaska Department of Fish and Game, Fishery Data Series No. 08-45, Anchorage. http://www.adfg.alaska.gov/FedAidpdfs/fds08-45.pdf

Loopstra, D., C. Olito, and P. Hansen. 2000. Marking, enumeration, and size estimation for coho and Chinook salmon smolt releases into Upper Cook Inlet, Alaska in 1999. Alaska Department of Fish and Game, Fishery Data Series No. 00-8, Anchorage. http://www.adfg.alaska.gov/FedAidPDFs/fds00-08.pdf

Loopstra, D. P., and P. A. Hansen. 2010. Coho and Chinook salmon smolt releases into Cook Inlet, Prince William Sound, and Resurrection Bay, Alaska, 2007. Alaska Department of Fish and Game, Fishery Data Series No. 10-04, Anchorage. http://www.adfg.alaska.gov/FedAidpdfs/FDS10-04.pdf

Loopstra, D. P., and P. A. Hansen. 2015a. Coho and Chinook salmon smolt releases into Cook Inlet, Prince William Sound, and Resurrection Bay, Alaska, 2009. Alaska Department of Fish and Game, Fishery Data Series 15-29, Anchorage. http://www.adfg.alaska.gov/FedAidpdfs/FDS15-29.pdf

Loopstra, D. P., and P. A. Hansen. 2015b. Coho and Chinook salmon smolt releases into Cook Inlet, Prince William Sound, and Resurrection Bay, Alaska, 2010. Alaska Department of Fish and Game, Fishery Data Series 15-30, Anchorage. http://www.adfg.alaska.gov/FedAidpdfs/FDS15-30.pdf

Monk, K. M. *Unpublished*. Thermal marking manual: A guideline to the induction of thermal marks in otoliths for the purpose of mass-marking hatchery stocks. Located at Alaska Department of Fish and Game, Division of Commercial Fisheries Management and Development, Mark, Tag, and Age Laboratory, 10107 Bentwood Place, Juneau, Alaska, 99802-5526.

Peltz, L., and P. A. Hansen. 1994. Marking, enumeration, and size estimation for coho and Chinook salmon smolt releases into upper Cook Inlet, Alaska in 1993. Alaska Department of Fish and Game, Fishery Data Series No. 94-21, Anchorage. http://www.adfg.alaska.gov/FedAidPDFs/fds94-21.pdf

Peltz, L., and D. Starkey. 1993. Summary and synthesis of production, marking, and release data for coho and Chinook salmon smolt releases into upper Cook Inlet, Alaska in 1992. Alaska Department of Fish and Game, Fishery Data Series No. 93-51, Anchorage. http://www.adfg.alaska.gov/FedAidPDFs/fds93-51.pdf

Starkey, D., C. Olito, and P. Hansen. 1999. Marking, enumeration, and size estimation for coho and Chinook salmon smolt releases into upper Cook Inlet and Resurrection Bay, Alaska in 1997. Alaska Department of Fish and Game, Fishery Data Series No. 99-1, Anchorage. http://www.adfg.alaska.gov/FedAidPDFs/fds99-01.pdf

Sweet, D. E., and L. R. Peltz. 1994. Performance of the Chinook salmon enhancement program in Willow Creek, Alaska, 1985-1993. Alaska Department of Fish and Game, Fishery Manuscript No. 94-3, Anchorage. http://www.adfg.alaska.gov/FedAidPDFs/fms94-03.pdf

Thompson, D. A., and H. L. Blankenship. 1997. Regeneration of adipose fins given complete and incomplete clips. North American Journal of Fisheries Management 17: 467-469.

APPENDIX A: HISTORICAL RELEASES OF CHINOOK AND COHO SALMON SMOLTS

Appendix A1.–Historical releases of coho salmon smolt with numbers of thermally marked, adipose-finclipped and coded-wire-tagged fish.

					Total released		Released with coded wire tag			Thermal marking	
Brood year	Brood stock	Hatchery	Release year	CWT Code	Estimate	Type [a]	Clipped	Tagged	Percent tagged	Mark group [b]	Hatch code
Anchorage Urban Streams [c]											
1994	Little Susitna	Ft Richardson	1996	31-25-06	302,857	M-R	93,975	92,565	30.56%		
Bird Creek											
1990	Little Susitna	Ft Richardson	1992	31-20-02, 03	95,377	M-R	44,903	37,629	39.50%		
1991	Little Susitna	Ft Richardson	1993	31-21-39	140,382	M-R	43,441	42,350	30.20%		
1992	Little Susitna	Ft Richardson	1994	31-23-02	84,643	M-R	45,220	44,686	52.80%		
1993	Little Susitna	Ft Richardson	1995	31-23-37	154,753	M-R	45,666	45,490	29.40%		
1994	Little Susitna	Ft Richardson	1996	31-25-04	147,618	M-R	46,528	45,411	30.80%		
1995	Little Susitna	Ft Richardson	1997	31-26-01	146,612	HI	45,901	45,488	31.03%		
1995	Little Susitna	Ft Richardson	1997	31-26-27	147,953	HI	45,836	45,469	30.73%		
1996	Little Susitna	Ft Richardson	1998	31-26-25	164,211	HI	46,140	46,094	28.07%		
1997	Ship Cr (Little Susitna)	Ft Richardson	1999	31-26-15	111,430	EC	37,344	36,746	32.98%		
1998	Ship Cr (Little Susitna)	Ft Richardson	2000	31-01-43	97,409	EC	40,114	39,392	40.44%		
2002	Ship Cr (Little Susitna)	Ft Richardson	2004		109,949	HI				CI	5H
2003	Ship Cr (Little Susitna)	Ft Richardson	2005 [d]		100,605	HI					
2004	Ship Cr (Little Susitna)	Ft Richardson	2006		104,974	HI				CI	5H
2005	Ship Cr (Little Susitna)	Ft Richardson	2007		104,979	HI				CI	1,5H
2006	Ship Cr (Little Susitna)	Ft Richardson	2008		113,035	HI				CI	1,5H
2007	Ship Cr (Little Susitna)	Ft Richardson	2009		113,300	HI				CI	1,5H [e]
2008	Ship Cr (Little Susitna)	Ft Richardson	2010		157,534	HI				CI	1,5H [f]
2009	Ship Cr (Little Susitna)	Ft Richardson	2011		136,047	HI				CI	1,5H [g]
Campbell Creek [c]											
1990	Little Susitna	Ft Richardson	1992	31-20-04, 05	97,076	M-R	43,681	39,444	40.60%		
1991	Little Susitna	Ft Richardson	1993	31-21-38	140,797	M-R	43,440	42,916	30.50%		
1992	Little Susitna	Ft Richardson	1994	31-23-03	87,686	M-R	44,144	42,963	49.00%		
1993	Little Susitna	Ft Richardson	1995	31-23-36	157,241	M-R	45,655	44,995	28.60%		
1995	Little Susitna	Ft Richardson	1997	31-25-62	71,519	TI	45,840	45,290	63.33%		
1996	Little Susitna	Ft Richardson	1998	31-26-52	83,317	HI	22,453	22,296	26.76%		
1997	Ship Cr (Little Susitna)	Ft Richardson	1999	31-01-30	42,046	EC	20,879	20,378	48.47%		

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Brood year	Brood stock	Hatchery	Release year	CWT Code	Total released		Released with coded wire tag			Thermal marking	
					Estimate	Type [a]	Clipped	Tagged	Percent tagged	Mark group [b]	Hatch code
Campbell Creek [c] (continued)											
1998	Ship Cr (Little Susitna)	Ft Richardson	2000	31-02-30	63,730	EC	19,948	19,549	30.67%		
1999	Ship Cr (Little Susitna)	Ft Richardson	2001	31-02-32	69,836	HI	21,568	20,813	29.80%		
2000	Ship Cr (Little Susitna)	Ft Richardson	2002	31-01-97	61,323	HI	22,789	21,672	35.34%	CI	5H
2001	Ship Cr (Little Susitna)	Ft Richardson	2003		78,576	HI				CI	5H
2002	Ship Cr (Little Susitna)	Ft Richardson	2004		85,790	HI				CI	5H
2003	Ship Cr (Little Susitna)	Ft Richardson	2005 [d]		60,387	HI					
2004	Ship Cr (Little Susitna)	Ft Richardson	2006		78,405	HI				CI	5H
2005	Ship Cr (Little Susitna)	Ft Richardson	2007		82,794	HI				CI	1,5H
2006	Ship Cr (Little Susitna)	Ft Richardson	2008		83,421	HI				CI	1.5H
2007	Ship Cr (Little Susitna)	Ft Richardson	2009		15,400	VOL				CI	1,5H [e]
2008	Ship Cr (Little Susitna)	Ft Richardson	2010		50,214	HI				CI	1,5H [f]
2009	Ship Cr (Little Susitna)	Ft Richardson	2011		71,960	VOL				CI	1,5H [g]
Cottonwood Creek											
1990	Fish Creek	Big Lake	1992	31-20-08 31-21-09	53,900	M-R	35,341	32,938	61.10%		
1991	Fish Creek	Big Lake	1993	31-21-41	74,198	M-R	43,117	40,875	55.10%		
Eklutna Tailrace											
1996	Jim Creek	Ft Richardson	1998	31-26-27, 54, 55, 56	112,219	TI	112,219	111,882	99.70%		
1997	Jim Creek	Ft Richardson	1999	31-26-16	126,602	EC	44,073	42,663	33.70%		
1998	Jim Creek	Ft Richardson	2000	31-01-46	76,851	EC	40,514	40,149	52.24%		
1999	Eklutna Tailrace	Ft Richardson	2001	31-02-47	124,838	HI	43,713	43,494	34.84%		
2000	Eklutna Tailrace	Ft Richardson	2002	31-02-46	120,629	HI	44,518	44,295	36.72%	CI	5H
2001	Eklutna Tailrace	Ft Richardson	2003		120,736	HI				CI	5H
2002	Eklutna Tailrace	Ft Richardson	2004		131,979	HI				CI	5H
2003	Eklutna Tailrace	Ft Richardson	2005 [d]		132,149	HI					
2004	Eklutna Tailrace	Ft Richardson	2006		132,212	HI				CI	5H

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Brood year	Brood stock	Hatchery	Release year	CWT Code	Total released		Released with coded wire tag			Thermal marking	
					Estimate	Type [a]	Clipped	Tagged	Percent tagged	Mark group [b]	Hatch code
Eklutna Tailrace (continued)											
2005	Eklutna Tailrace	Ft Richardson	2007		118,054	HI				CI	1,5H
2006	Eklutna Tailrace	Ft Richardson	2008		118,139	HI				CI	1,5H
2007	Jim Creek	Ft Richardson	2009		120,200	HI				CI	1,5H [e]
2008	Jim Creek	Ft Richardson	2010		131,123	HI				CI	1,5H [f]
2009	Jim Creek	Ft Richardson	2011		97,087	HI				CI	1,5H [g]
Fish Creek											
1990	Fish Creek	Big Lake	1992	31-20-12,13	74,953	M-R	45,538	43,625	58.20%		
1991	Fish Creek	Big Lake	1993	31-21-40	67,934	M-R	44,050	43,257	63.70%		
Homer Spit											
1996	Bear Lake	Elmendorf	1998	31-26-28	130,219	M-R	42,057	41,926	32.20%		
1997	Bear Lake	Elmendorf	1999	31-01-40	129,602	M-R	44,405	43,020	33.19%		
	Bear Lake	Elm/Ft. Rich	2000–01 [d]								
1999	Ship Cr (Little Susitna)	Ft Richardson	2001	31-01-36	100,280	HI	44,992	44,812	44.69%		
2000	Ship Cr (Little Susitna)	Ft Richardson	2002	31-01-98	95,648	HI	45,498	44,179	46.19%	CI	5H
2000	Bear Lake	Ft Richardson	2002		120,707	HI				CI	5H
2001	Ship Cr (Little Susitna)	Ft Richardson	2003		222,935	HI				CI	5H
2002	Ship Cr (Little Susitna)	Ft Richardson	2004		130,243	HI				CI	5H
2003	Ship Cr (Little Susitna)	Ft Richardson	2005 [d]		125,707	HI					
2004	Ship Cr (Little Susitna)	Ft Richardson	2006		125,216	HI				CI	5H
2005	Ship Cr (Little Susitna)	Ft Richardson	2007		127,711	HI				CI	1,5H
2006	Ship Cr (Little Susitna)	Ft Richardson	2008		122,843	HI				CI	1,5H
2007	Ship Cr (Little Susitna)	Ft Richardson	2009		113,696	HI				CI	1,5H [e]
2008	Ship Cr (Little Susitna)	Ft Richardson	2010		130,206	HI				CI	1,5H [f]
2009	Bear Lake/Ship Cr (Little Susitna)	Ft Richardson	2011		129,080	HI				CI	1,5H [g]
Little Susitna at Houston											
1990	Little Susitna	Ft Richardson	1992	31-20-07	154,466	M-R	21,884	19,564	12.70%		
1991	Little Susitna	Ft Richardson	1993	31-21-37	148,282	M-R	21,404	20,312	13.70%		

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Brood year	Brood stock	Hatchery	Release year	CWT Code	Total released		Released with coded wire tag			Thermal marking	
					Estimate	Type [a]	Clipped	Tagged	Percent tagged	Mark group [b]	Hatch code
Lowell Creek											
2000	Bear Lake	Ft Richardson	2002		119,512	HI				RB	4H
2001	Bear Lake	Ft Richardson	2003		124,389	HI				RB	4H
2002	Bear Lake	Ft Richardson	2004		131,989	HI				RB	4H
2003	Bear Lake	Ft Richardson	2005 [d]		132,276	HI					
2004	Bear Lake	Ft Richardson	2006		131,261	HI				RB	4H
2005	Bear Lake	Ft Richardson	2007		130,682	HI				RB	2,4H
2007	Bear Lake	Ft Richardson	2009		91,833	HI				RB	2,4H
2008	Bear Lake	Ft Richardson	2010		133,947	HI				RB	2,4H
Nancy Lake											
1990	Little Susitna	Ft Richardson	1992	31-20-06	158,459	M-R	21,598	19,222	12.10%		
1991	Little Susitna	Ft Richardson	1993	31-21-37	131,591	M-R	21,001	19,930	15.20%		
1992	Little Susitna	Ft Richardson	1994	31-23-01	126,694	M-R	44,489	43,818	34.60%		
1993	Little Susitna	Ft Richardson	1995	31-23-39	151,985	M-R	46,261	45,245	29.80%		
Seward Lagoon											
2000	Bear Lake	Ft Richardson	2002		121,743	HI				RB	4H
2001	Bear Lake	Ft Richardson	2003		123,718	HI				RB	4H
2002	Bear Lake	Ft Richardson	2004		131,798	HI				RB	4H
2003	Bear Lake	Ft Richardson	2005 [d]		132,229	HI					
2004	Bear Lake	Ft Richardson	2006		131,326	HI				RB	4H
2005	Bear Lake	Ft Richardson	2007		132,811	HI				RB	2,4H
2006	Bear Lake	Ft Richardson	2008		233,365	HI				RB	2,4H
2007	Bear Lake	Ft Richardson	2009		91,979	HI				RB	2,4H [e]
2008	Bear Lake	Ft Richardson	2010		134,008	HI				RB	2,4H [f]
2009	Bear Lake	Ft Richardson	2011		255,252	HI				RB	2,4H [g]

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Brood year	Brood stock	Hatchery	Release year	CWT Code	Total released: Estimate	Total released: Type [a]	Released with coded wire tag: Clipped	Released with coded wire tag: Tagged	Released with coded wire tag: Percent tagged	Thermal marking: Mark group [b]	Thermal marking: Hatch code
Ship Creek [c]											
1990	Ship Creek	Elmendorf	1992	31-19-63	67,178	TI	44,086	38,443	57.20%		
				31-20-01							
1991	Ship Creek	Elmendorf	1993	31-21-36	54,764	TI/PC	42,112	41,322	75.50%		
1992	Ship Creek	Elmendorf	1994	31-23-04	75,779	TI/PC	44,031	41,722	55.10%		
1993	Little Susitna	Ft Richardson	1995	31-23-38	158,981	M-R	45,491	44,654	28.10%		
1995	Little Susitna	Ft Richardson	1997	31-25-63	232,066	TI,HI	45,925	45,741	19.71%		
1996	Little Susitna	Ft Richardson	1998	31-26-53, 26	232,765	HI	67,812	66,997	28.78%		
1997	Ship Cr (Little Susitna)	Ft Richardson	1999	31-26-14	165,388	EC	48,299	45,380	27.44%		
				31-01-29							
1998	Ship Cr (Little Susitna)	Ft Richardson	2000	31-01-32	260,070	EC	61,640	58,989	22.68%		
				31-01-33							
1999	Ship Cr (Little Susitna)	Ft Richardson	2001	31-02-61	233,563	HI	64,165	61,663	26.40%		
2000	Ship Cr (Little Susitna)	Ft Richardson	2002	31-02-83	212,639	HI	67,959	63,678	29.95%	CI	5H
2001	Ship Cr (Little Susitna)	Ft Richardson	2003	31-02-74, 69	234,716	HI	64,234	64,125	27.32%	CI	5H
2002	Ship Cr (Little Susitna)	Ft Richardson	2004	31-02-81	241,066	HI	63,222	62,906	26.09%	CI	5H
				31-03-15							
2003	Ship Cr (Little Susitna)	Ft Richardson	2005 [d]		251,446	HI					
2004	Ship Cr (Little Susitna)	Ft Richardson	2006		252,775	HI				CI	5H
2005	Ship Cr (Little Susitna)	Ft Richardson	2007		255,400	HI				CI	1,5H
2006	Ship Cr (Little Susitna)	Ft Richardson	2008		245,490	HI				CI	1,5H
2007	Ship Cr (Little Susitna)	Ft Richardson	2009		287,825	HI				CI	1,5H [e]
2008	Ship Cr (Little Susitna)	Elmendorf	2010		252,319	HI				CI	1,5H [f]
2009	Ship Cr (Little Susitna)	Ft Richardson	2011		254,718	HI				CI	1,5H [g]

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Brood year	Brood stock	Hatchery	Release year	CWT Code	Total released: Estimate	Total released: Type [a]	Released with coded wire tag: Clipped	Released with coded wire tag: Tagged	Released with coded wire tag: Percent tagged	Thermal marking: Mark group [b]	Thermal marking: Hatch code
Wasilla Creek											
1990	Fish Cr	Big Lake	1992	31-20-10	76,315	M-R	44,148	41,985	55.00%		
				31-20-11							
1991	Fish Cr	Big Lake	1992	31-21-42	77,174	M-R	43,001	41,711	54.10%		
1994	Little Susitna	Ft Richardson	1996	31-25-05	145,923	M-R	46,980	46,839	32.10%		

[a] Type of estimate: M-R is mark–recapture; TI is tagging inventory; HI is hatchery inventory; EC is electronic count; PC is physical count.

[b] CI is Cook Inlet; RB is Resurrection Bay.

[c] Campbell and Ship creeks were combined and termed “Anchorage Urban Streams” in 1996.

[d] Stocking continued, but releases did not contain tagged or thermally marked fish.

[e] See Loopstra and Hansen 2015a.

[f] See Loopstra and Hansen 2015b.

[g] See Table 3 for altered mark details.

Appendix A2.–Historical releases of Chinook salmon smolt with numbers of thermally marked, adipose finclipped, and coded-wire-tagged fish.

					Total released		Released with coded wire tag			Thermal marking	
Brood year	Brood stock	Hatchery	Release year	CWT Code	Estimate	Type [a]	Clipped [b]	Released	Percent tagged	Mark group [c]	Hatch code
Buskin River											
1994	Deception Cr	Elmendorf	1995	31-24-31	84,349	M-R	41,572	41,078	48.70%		
1995	Deception Cr	Elmendorf	1996	31-25-09	113220	M-R	41259	40681	35.90%		
Crooked Creek											
1993	Crooked Cr	Elmendorf	1994	31-23-14	224,784	M-R	43,609	43,034	19.10%		
1994	Homer (Crooked Cr)	Elmendorf	1995	31-24-27	184,049	M-R	40,903	38,420	20.90%		
1995	Homer (Crooked Cr)	Elmendorf	1996	31-25-12	193,180	M-R	40,827	40,196	20.80%		
1996	Homer (Crooked Cr)	Elmendorf	1997	31-25-55	223,200	M-R	41,049	39,038	17.49%		
1997	Homer (Crooked Cr)	Elmendorf	1998	31-26-29	137,338	M-R	42,874	42,610	31.03%		
1998	Homer (Crooked Cr) [d]	Elmendorf	1999	31-01-41	192,304	M-R	43,431	42,649	22.17%		
1999	Crooked Cr	Elmendorf	2000	31-02-31	108,507	TI	108,507	105,578	97.30%		
2000	Crooked Cr	Elmendorf	2001	31-01-34, 35 31-01-95	109,201	TI	109,201	107,454	98.40%		
2001	Crooked Cr	Elmendorf	2002	31-02-36, 37 31-02-51	99,547	TI	99,547	98,452	98.90%	CC	2,4H4 [e]
2002	Crooked Cr	Ft Richardson	2003	31-01-96, 99 31-02-72, 73, 68	98,800	TI	98,800	94,058	95.20%	CI	2,3H
2002	Crooked Cr	Ft Richardson	2004	31-02-79, 80	80,601	TI	80,601	75,120	93.20%	CI	2,3H
2003	Crooked Cr	Ft Richardson	2005	31-03-39, 40, 17	113,613	TI	113,071	113,499	99.90%	CI	2,3H [f]
2004	Crooked Cr [g]	Ft Richardson	2006	31-03-56, 57, 51	111,705	TI	111,705	111,705	100.0%	CI	2,3H
2005	Crooked Cr [h]	Ft Richardson	2007	31-03-68, 52	111,382	TI	111,382	111,271	99.9%	CI	2,3H
2006	Crooked Cr	Ft Richardson	2008	31-03-69, 70	114,588	TI	114,588	113,213	98.8%	CI	2,3H
2007	Crooked Cr	Ft Richardson	2009	31-03-75, 74, 14	115,035	TI	114,734	114,115	99.2%	CI	2,3H [i]
2008	Crooked Cr	Ft Richardson	2010	31-03-78	106,145	TI	106,145	105,190	99.1%	CI	2,3H
2009	Crooked Cr	Ft Richardson	2011		64,578	ClpI	64,578 [j]			CI	2,3H
Deception Creek											
1991	Deception Cr	Ft Richardson	1992	31-21-03	179,724	M-R	44,089	33,464	18.60%		
1992	Deception Cr	Ft Richardson	1993	31-21-60	160,194	M-R	42,782	39,420	24.60%		

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Brood year	Brood stock	Hatchery	Release year	CWT Code	Total released: Estimate	Total released: Type[a]	Released with coded wire tag: Clipped [b]	Released with coded wire tag: Tagged	Released with coded wire tag: Percent tagged	Thermal marking: Mark group [c]	Thermal marking: Hatch code
Deception Creek (continued)											
1993	Deception Cr	Ft Richardson	1994	31-23-17	177,913	M-R	46,289	45,921	25.80%		
1994	Deception Cr	Ft Richardson	1995	31-24-34	184,740	M-R	46,807	46,256	25.00%		
1995	Deception Cr	Ft Richardson	1996	31-25-14	186,918	M-R	47,700	47,145	25.20%		
1996	Deception Cr	Ft Richardson	1997	31-26-03, 04, 05, 06, 07	209,644	TI	209,644	207,973	99.20%		
1997	Deception Cr	Ft Richardson	1998	31-25-32	197,392	TI	197,392	195,615	99.10%		
1998	Deception Cr	Ft Richardson	1999	31-26-17, 18, 19, 20	201,586	TI	201,586	199,722	99.08%		
1999	Deception Cr	Ft Richardson	2000	31-01-31 31-26-21 31-01-44	206,496	TI	206,496	205,051	99.30%		
2000	Deception Cr	Ft Richardson	2001	31-02-33, 34, 35 31-02-41, 42, 43, 44, 45	207,465	TI	207,465	204,560	98.60%		
2001	Deception Cr	Ft Richardson	2002	31-01-92 31-02-52, 53, 54, 55	197,277	TI	197,277	196,608	99.66%	DC	2,5H
2002	Deception Cr	Ft Richardson	2003	31-02-70, 71 31-01-94	101,181	TI	101,181	99,562	98.40%	CI	2,3H
2002	Deception Cr	Ft Richardson	2004	31-02-77, 78 31-03-16	113,523	TI	113,523	104,101	91.70%	CI	2,3H [k]
2003	Deception Cr	Elmendorf	2004	31-02-75, 76 31-01-27	99,047	TI	99,047	97,660	98.60%	CI	2,3H
2003	Deception Cr	Ft Richardson	2005	31-03-28, 29, 30, 31	163,016	TI	161,991	162,415	99.63%	CI	2,3H [f]
2004	Deception Cr [g]	Ft Richardson	2006	31-03-53, 54, 55, 27	50,426	TI	50,426	50,376	99.90%	CI	2,3H
2005	Deception Cr	Ft Richardson	2007	31-03-67, 26	103,016	TI	103,016	103,016	100.00%	CI	2,3H
2006	Deception Cr	Ft Richardson	2008	31-03-71, 73	112,219	TI	112,219	111,321	99.20%	CI	2,3H
2007	Deception Cr [g]	Ft Richardson	2009	31-03-77, 50, 49	111,322	TI	111,099	111,322	100.00%	CI	2,3H [i]
2008	Deception Cr	Ft Richardson	2010	31-03-80, 81	155,125	TI	155,125	154,815	99.80%	CI	2,3H
2009	Deception Cr	Ft Richardson	2011		140,266	ClpI	140,266 [j]			CI	2,3H

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Brood year	Brood stock	Hatchery	Release year	CWT Code	Total released: Estimate	Total released: Type [a]	Released with coded wire tag: Clipped [b]	Released with coded wire tag: Tagged	Released with coded wire tag: Percent tagged	Thermal marking: Mark group [c]	Thermal marking: Hatch code
Eagle River											
1993	Ship Creek	Elmendorf	1994	31-23-13	98,872	M-R	43,612	41,669	42.10%		
Eklutna Tailrace											
2001	Ship Creek	Elmendorf	2002		106,991	VOL				ET	2,3H3
2002	Ship Creek	Ft Richardson	2003		218,492	HI				CI	2,3H
2002	Ship Creek	Ft Richardson	2004		215,165	HI				CI	2,3H [k]
2003	Ship Creek	Ft Richardson	2005		164,586	HI				CI	2,3H [f]
2004	Ship Creek	Ft Richardson	2006		213,250	HI				CI	2,3H
2005	Ship Creek	Ft Richardson	2007		110,978	HI				CI	2,3H
2006	Ship Creek	Ft Richardson	2008		114,136	HI				CI	2,3H
2007	Ship Creek	Ft Richardson	2009		77,785	VOL				CI	2,3H [i]
2008	Ship Creek	Ft Richardson	2010		152,014	HI				CI	2,3H
2009	Ship Creek	Ft Richardson	2011		122,962	HI				CI	2,3H
Fleming Spit											
1998	Deception Cr	Ft Richardson	1999	31-26-23	49,773	TI	45,705	45,385	91.18%		
1999	Deception Cr	Elmendorf	2000	31-01-38	45,000	VIS	17,358	17,236	38.30%		
2000	Deception Cr	Elmendorf	2001	31-02-38	94,812	HI	40,659	40,415	42.63%		
2001	Deception Cr	Ft Richardson	2002	31-02-57	109,656	HI	40,054	39,573	36.09%	PWS	2,4H
2002	Deception Cr	Ft Richardson	2003		109,757	HI				PWS	2,4H
2003	Deception Cr	Ft Richardson	2004		58,000	HI				PWS	2,4H
2003	Deception Cr	Ft Richardson	2005		87,591	HI				PWS	2,4H [f]
2004	Ship Creek [l]	Ft Richardson	2006		113,576	HI				CI	2,3H
2005	Deception Cr	Ft Richardson	2007		119,860	HI				PWS	2,4H
2006	Deception Cr	Ft Richardson	2008		114,627	HI				PWS	2,4H
2007	Deception Cr	Ft Richardson	2009		68,173	HI				PWS	2,4H
2008	Deception Cr	Ft Richardson	2010		111,383	HI				PWS	2,4H
2009	Deception/Ship Cr	Ft Richardson	2011		86,428	HI				PWS	2,4H

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Brood year	Brood stock	Hatchery	Release year	CWT Code	Total released		Released with coded wire tag			Thermal marking	
					Estimate	Type [a]	Clipped [b]	Tagged	Percent tagged	Mark group [c]	Hatch code
Halibut Cove											
1993	Crooked Creek	Elmendorf	1994	31-23-15	98,872	M-R	21,205	21,038	21.30%		
1994	Ninilchik River	Elmendorf	1995	31-24-30	37,577	M-R	36,944	36,700	97.70%		
1995	Ninilchik River	Elmendorf	1996	31-25-11	97,729	M-R	40,688	39345	40.30%		
1996	Ninilchik River	Elmendorf	1997	31-25-58	78,133	M-R	40,919	39487	50.54%		
1997	Ninilchik River	Elmendorf	1998	31-26-32	65,893	M-R	38,476	38041	57.73%		
	Ninilchik River	Elmendorf	1999–01 [m]								
2001	Ninilchik River	Elmendorf	2002		106,279	VOL				KB	2,4H3
2002	Ninilchik River	Ft Richardson	2003		106,844	HI				CI	2,3H
2002	Ninilchik River	Ft Richardson	2004		103,771	HI				CI	2,3H
2003	Ninilchik River	Ft Richardson	2005		112,521	HI				CI	2,3H [f]
2004	Ninilchik River	Ft Richardson	2006		117,549	HI				CI	2,3H
2005	Ninilchik River [h]	Ft Richardson	2007		54,560	HI				CI	2,3H
2006	Ninilchik River	Ft Richardson	2008		58,674	HI				CI	2,3H
2007	Ninilchik River	Ft Richardson	2009		35,065	WV				CI	2,3H [i]
2008	Ninilchik River	Ft Richardson	2010		111,134	HI				CI	2,3H
2009	Ninilchik River	Ft Richardson	2011 [j]		107,338	HI				CI	2,3H
Homer Spit (early run)											
1993	Crooked Creek	Elmendorf	1994	31-23-16	163,963	M-R	26,003	25,615	15.60%		
1994	Homer (Crooked Cr)	Elmendorf	1995	31-24-32	216,026	M-R	41,650	40,291	18.70%		
1995	Homer (Crooked Cr)	Elmendorf	1996	31-25-07	204,085	M-R	40,868	39,017	19.10%		
1996	Homer (Crooked Cr)	Elmendorf	1997	31-25-60	217,773	M-R	41,112	38,810	17.82%		
1997	Homer (Crooked Cr)	Elmendorf	1998	31-26-33	177,730	M-R	40,012	39,652	22.31%		
1998	Homer (Crooked Cr)	Elmendorf	1999	31-01-45	163,170	M-R	42,561	40,423	24.77%		
	Ninilchik River	Elmendorf	2000–01 [m]								
2001	Ninilchik River	Elmendorf	2002		190,026	VOL				KB	2,5H3
2002	Ninilchik River	Ft Richardson	2003		206,292	HI				CI	2,3H
2002	Ninilchik River	Ft Richardson	2004		143,037	HI				CI	2,3H
2003	Ninilchik River	Elmendorf	2004		25,706	VOL				CI	2,3H
2003	Ninilchik River	Ft Richardson	2005		220,822	HI				CI	2,3H [f]
2004	Ninilchik River	Ft Richardson	2006		224,053	HI				CI	2,3H

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Brood year	Brood stock	Hatchery	Release year	CWT Code	Total released		Released with coded wire tag			Thermal marking	
					Estimate	Type [a]	Clipped [b]	Tagged	Percent tagged	Mark group [c]	Hatch code
Homer Spit (early run, continued)											
2005	Ninilchik River	Ft Richardson	2007		226,972	HI				CI	2,3H
2006	Ninilchik River	Ft Richardson	2008		212,141	HI				CI	2,3H
2007	Ninilchik River	Ft Richardson	2009		164,234	HI				CI	2,3H [i]
2008	Ninilchik River	Ft Richardson	2010		107,706	HI				CI	2,3H
2008	Crooked Creek	Ft Richardson	2010		105,797	HI				CI	2,3H
2009	Crooked Creek	Ft Richardson	2011		108,003	HI				CI	2,3H
Homer Spit (late run)											
1992	Kasilof River	Crooked Creek	1994	31-23-19	56,920	M-R	22,612	22,383	39.30%		
1994	Homer (Kasilof R)	Elmendorf	1995	31-24-33	123,048	M-R	41,054	40,466	32.90%		
1995	Homer (Kasilof R)	Elmendorf	1996	31-25-13	108,204	M-R	40,615	38,787	35.80%		
1996	Homer (Kasilof R)	Elmendorf	1997	31-25-61	100,933	M-R	41,028	39,264	38.90%		
1997	Homer (Kasilof R)	Elmendorf	1998	31-26-34	112,100	HI	40,158	39,997	35.68%		
	Homer (Kasilof R)	Elmendorf	1999 [m]								
Lowell Creek											
1996	Deception Cr	Elmendorf	1997	31-25-59	102,147	M-R	40,906	40,497	39.65%		
	Deception Cr	Elmendorf	1998–99 [m]								
	Crooked Creek	Elmendorf	2000–01 [m]								
2001	Crooked Creek	Elmendorf	2002		93,296	VOL				RB	2,5H3
2002	Crooked Creek	Ft Richardson	2003		110,331	HI				RB	2,5H
2002	Crooked Creek	Ft Richardson	2004		89,388	HI				RB	2,5H
2003	Crooked Creek	Ft Richardson	2005		100,088	HI				RB	2,5H [f]
2008	Crooked Creek	Ft Richardson	2010		109,779	HI				RB	2,5H
Ninilchik River											
1991	Ninilchik River	Ft Richardson	1992	31-21-04	132,387	M-R	43,648	41,335	31.20%		
1992	Ninilchik River	Ft Richardson	1993	31-21-59	184,585	M-R	44,487	42,960	23.30%		
1993	Ninilchik River	Ft Richardson	1994	31-23-18	201,513	M-R	46,193	45,535	22.60%		
1994	Ninilchik River	Ft Richardson	1995	31-24-35	54,902	TI	54,902	54,353	99.00%		
1995	Ninilchik River	Ft Richardson	1996	31-25-15	51,688	TI	51,588	50,866	98.60%		

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Brood year	Brood stock	Hatchery	Release year	CWT Code	Total released		Released with coded wire tag			Thermal marking	
					Estimate	Type [a]	Clipped [b]	Tagged	Percent tagged	Mark group [c]	Hatch code
Ninilchik River (continued)											
1996	Ninilchik River	Ft Richardson	1997	31-26-08	50,698	TI	50,698	50,292	99.20%		
1997	Ninilchik River	Ft Richardson	1998	31-26-35	48,798	TI	48,798	47,480	97.30%		
1998	Ninilchik River	Ft Richardson	1999	31-01-47	49,853	TI	49,853	48,906	98.10%		
1999	Ninilchik River	Ft Richardson	2000	31-02-48	51,298	TI	51,298	50,016	97.50%		
2000	Ninilchik River	Ft Richardson	2001	31-02-60	54,770	TI	54,770	54,441	99.40%		
2001	Ninilchik River	Ft Richardson	2002	31-02-82	54,631	TI	54,631	54,139	99.10%	NR	2,3H
2002	Ninilchik River	Ft Richardson	2003	31-02-56	47,997	TI	47,997	44,349	92.40%	CI	2,3H
				31-01-83							
2002	Ninilchik River	Ft Richardson	2004	31-03-18	51,303	TI	51,303	51,252	99.90%	CI	2,3H
2003	Ninilchik River	Ft Richardson	2005	31-03-41	55,229	TI	54,806	54,898	99.40%	CI	2,3H [f]
2004	Ninilchik River [g]	Ft Richardson	2006	31-03-58	57,537	TI	57,537	57,537	100.00%	CI	2,3H
2005	Ninilchik River	Ft Richardson	2007	31-03-66	56,325	TI	56,037	55,869	99.19%	CI	2,3H
2006	Ninilchik River	Ft Richardson	2008	31-03-72	56,943	TI	56,868	56,658	99.50%	CI	2.3H
2007	Ninilchik River	Ft Richardson	2009	31-03-76	54,797	TI	54,797	54,304	99.10%	CI	2,3H [i]
2008	Ninilchik River	Ft Richardson	2010	31-03-79	58,297	TI	58,297	57,248	98.20%	CI	2,3H
2009	Ninilchik River	Ft Richardson	2011 [j]		59,462	ClpI	59,462 [j]			CI	2,3H
Seldovia											
1993	Crooked Creek	Elmendorf	1994	31-23-11	107,246	M-R	46,754	45,439	42.40%		
1994	Homer (Crooked Cr)	Elmendorf	1995	31-24-29	116,165	M-R	41,609	40,678	35.00%		
1995	Ninilchik River	Elmendorf	1996	31-25-10	118,274	M-R	40,667	39,610	33.50%		
1996	Ninilchik River	Elmendorf	1997	31-25-57	103,757	M-R	41,279	39,834	38.39%		
1997	Ninilchik River	Elmendorf	1998	31-26-31	69,461	M-R	40,654	40,125	57.77%		
	Ninilchik River	Elmendorf	1999–01 [m]								
2001	Ninilchik River	Elmendorf	2002		83,045	VOL				KB	2,4H3
2002	Ninilchik River	Ft Richardson	2003		107,521	HI				CI	2.3H
2003	Ninilchik River	Elmendorf	2004		88,682	VOL				CI	2.3H
2003	Ninilchik River	Ft Richardson	2005		114,984	HI				CI	2.3H [f]
2004	Ninilchik River	Ft Richardson	2006		113,974	HI				CI	2,3H
2005	Ninilchik River	Ft Richardson	2006		54,276	HI				CI	2,3H

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Brood year	Brood stock	Hatchery	Release year	CWT Code	Total released: Estimate	Total released: Type [a]	Released with coded wire tag: Clipped [b]	Released with coded wire tag: Tagged	Released with coded wire tag: Percent tagged	Thermal marking: Mark group [c]	Thermal marking: Hatch code
Seldovia (continued)											
2006	Ninilchik River	Ft Richardson	2008		54,464	HI				CI	2,3H
2007	Ninilchik River	Ft Richardson	2009		44,487	VOL				CI	2,3H [i]
2008	Ninilchik River	Ft Richardson	2010		114,421	HI				CI	2,3H
2009	Crooked Creek	Ft Richardson	2011		103,382	HI				CI	2,3H
Seward Lagoon											
2001	Crooked Creek	Elmendorf	2002		100,314	VOL				RB	2,5H3
2002	Crooked Creek	Ft Richardson	2003		109,976	HI				RB	2,5H
2003	Crooked Creek	Elmendorf	2004		109,600	VOL				RB	2,5H
2003	Crooked Creek	Ft Richardson	2005		114,847	HI				RB	2,5H [f]
2004	Deception/Crooked Cks	Ft Richardson	2006		116,826	HI				RB	2,5H
2004	Ship Creek [l]	Ft Richardson	2006		109,795	HI				CI	2.3H
2008	Crooked/Ship Cks	Ft Richardson	2010		110,671	HI				RB	2,5H
2009	Ship Creek	Ft Richardson	2011		108,890	HI				RB	2,5H
Ship Creek											
1993	Ship Creek	Elmendorf	1994	31-23-12	199,830	M-R	44,138	42,864	21.50%		
1994	Ship Creek	Elmendorf	1995	31-24-28	218,487	M-R	40,764	38,570	17.70%		
1995	Ship Creek	Elmendorf	1996	31-25-08	231,444	M-R	41,221	40,109	17.30%		
1996	Ship Creek	Elmendorf	1997	31-25-56	326,371	M-R	40,522	40,319	12.36%		
1997	Ship Creek	Elmendorf	1998	31-26-30	204,741	M-R	42,073	41,565	20.30%		
1998	Ship Creek	Elmendorf	1999	31-01-42	197,168	M-R	44,265	42,262	21.44%		
	Ship Creek	Elmendorf	2000–01 [m]								
2001	Ship Creek	Elmendorf	2002		290,501	VOL				SC	2,4H4
2002	Ship Creek	Ft Richardson	2003		329,416	HI				CI	2,3H
2002	Ship Creek	Ft Richardson	2004		209,060	HI				CI	2,3H [k]
2003	Ship Creek	Elmendorf	2004		111,166	HI				CI	2,3H
2003	Ship Creek	Ft Richardson	2005		344,191	HI				CI	2,3H [f]
2004	Ship Creek	Elmendorf	2005		13,838	VOL					
2004	Ship Creek	Ft Richardson	2006		60,412	HI				CI	2,3H
2004	Ship Creek [l]	Ft Richardson	2006		115,643	HI				PWS	2,4H

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Brood year	Brood stock	Hatchery	Release year	CWT Code	Total released		Released with coded wire tag			Thermal marking	
					Estimate	Type [a]	Clipped [b]	Tagged	Percent tagged	Mark group [c]	Hatch code
Ship Creek (continued)											
2005	Ship Creek	Ft Richardson	2007		333,940	HI				CI	2,3H
2006	Ship Creek	Ft Richardson	2008		341,495	HI				CI	2,3H
2007	Ship Creek	Ft Richardson	2009		282,735	HI				CI	2,3H [i]
2008	Ship Creek	Elmendorf	2010		332,597	HI				CI	2,3H
2009	Ship Creek	Ft Richardson	2011		314,194	HI				CI	2,3H
Valdez Area											
1998	Deception Cr	Ft Richardson	1999	31-26-22	49,353	TI	46,528	45,923	93.05%		
1999	Deception Cr	Elmendorf	2000	31-01-37	115,582	M-R	41,728	41,060	35.52%		
2000	Deception Cr	Elmendorf	2001	31-02-39	94,701	HI	44,418	43,974	46.43%		
2001	Deception Cr	Ft Richardson	2002	31-02-58	107,861	HI	43,833	42,650	39.54%	PWS	2,4H
2002	Deception Cr	Ft Richardson	2003		109,661	HI				PWS	2,4H
2002	Deception Cr	Ft Richardson	2004		99,464	HI				PWS	2,4H [k]
2003	Deception Cr	Ft Richardson	2005		143,209	HI				PWS	2,4H [f]
2004	Ship Creek	Ft Richardson	2006		112,221	HI				PWS	2,4H
2005	Deception Cr	Ft Richardson	2007		126,241	HI				PWS	2,4H
2006	Deception Cr	Ft Richardson	2008		126,703	HI				PWS	2,4H
2007	Deception Cr	Ft Richardson	2009		107,883	HI				PWS	2,4H
2008	Deception Cr	Ft Richardson	2010		113,801	HI				PWS	2,4H
2009	Deception Cr	Ft Richardson	2011		113,782	HI				PWS	2,4H
Whittier Area											
1998	Deception Cr	Ft Richardson	1999	31-26-24	49,797	TI	45,023	43,897	88.21%		
1999	Deception Cr	Elmendorf	2000	31-01-39	119,389	M-R	43,551	42,898	35.93%		
2000	Deception Cr	Elmendorf	2001	31-02-40	95,823	HI	42,800	42,458	44.31%		
2001	Deception Cr	Ft Richardson	2002	31-02-59	109,763	HI	45,854	44,799	40.81%	PWS	2,4H
2002	Deception Cr	Ft Richardson	2003		109,700	HI				PWS	2,4H
2002	Deception Cr	Ft Richardson	2004		107,705	HI				PWS	2,4H [k]
2003	Deception Cr	Elmendorf	2004		20,906	VOL				PWS	2,4H
2003	Deception Cr	Ft Richardson	2005		118,059	HI				PWS	2,4H [f]
2008	Deception /Ship Cks	Ft Richardson	2010		108,881	HI				PWS	2,4H
2009	Ship Creek	Ft Richardson	2011		100,094	HI				PWS	2,4H

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[a] Type of estimate: M-R is mark–recapture; TI is tagging inventory; HI is hatchery inventory; VIS is a visual estimate; VOL is volumetric estimate; ClpI is clipping inventory.

[b] Beginning in 2005, number of clipped fish released is adjusted to reflect percent of acceptable finclips observed at release.

[c] CC is Crooked Creek; CI is Cook Inlet; DC is Deception Creek; ET is Eklutna Tailrace; KB is Kachemak Bay; NR is Ninilchik River; PWS is Prince William Sound; RB is Resurrection Bay; SC is Ship Creek.

[d] Corrections for release numbers reported in Loopstra et al. (2000).

[e] See Loopstra and Hansen (2005) for variant mark details.

[f] See Loopstra and Hansen (2008) for variant mark details.

[g] Not sampled for long-term coded wire tag retention or finclip quality at release. Coded wire tag data are based on overnight tag retention and acceptable finclip rates.

[h] Corrections for release numbers reported in Loopstra and Hansen (2010).

[i] See Loopstra and Hansen (2015a) for variant mark details.

[j] Fish released did not contain coded wire tags, but were marked with adipose finclips and thermal marks.

[k] See Loopstra and Hansen (2007) for altered mark details.

[l] Due to bacterial kidney disease (BKD) infection, release groups were switched at release in order to stock healthier fish at brood source release sites.

[m] Stocking continued, but releases did not contain tagged or thermally marked fish.

APPENDIX B: DISPLACEMENT VALUES FOR FISH TRANSPORT TANKS

Appendix B1.–Displacement values (kg/mm) for fish transport tanks.

Vehicle	Displacement kg/mm
SV33804	2.70
SV36544	2.60
SV36905	1.42
SV33697	2.20
SV33259	3.21

Source: John Unterberg, Alaska Department of Fish and Game, Fort Richardson Fish Hatchery, December 2010.